Abstract

This thesis contains detailed study of a newly discovered effect of quench switching in thin films of antiferromagnetic CuMnAs. This effect can be used to induce highly reproducible resistance switching behaviour in response to electrical or optical laser pulsing. The resistance changes reach up to GMR-like values of 20 % at room temperature and 100 % at low temperatures. We attribute these changes to the nano-fragmentation of magnetic domain structure.

After CuMnAs is pulsed into a high resistance state, a characteristic period of time follows, during which the resistance relaxes back to the original value. This relaxation can be described by Kohlrausch stretched exponential function. This type of relaxation is characteristic for behaviour of correlated complex systems, which goes well with the idea of highly fragmented and correlated magnetic states of quenched CuMnAs.

The quench switching effect is studied in detail on devices with different geometries, for various parameters of the writing pulse, as well as growth parameters of the CuMnAs films. The switching is demonstrated in CuMnAs films prepared on GaP, GaAs and Si substrates, where the quality of the film differs. This illustrates robustness and application potential of the effect.